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Treatability Studies Under CERCLA: AN OVERVIEW

Office of Emergency and Remedial Response
Hazardous Site Control Division OS-220
Quick Reference Fact Sheet

Section 121(b) of CERCLA mandates EPA to select remedies that "utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable" and to prefer remedial actions in which treatment "permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, and contaminants as a principal element." Treatability studies provide data to support treatment technology selection and remedy implementation and should be performed as soon as it is evident that insufficient information is available to ensure the quality of the decision. Regional planning should factor in the time and resources required for these studies.

This fact sheet provides a synopsis of information to facilitate the planning and execution of treatability studies in support of the RI/FS and the RD/RA processes. Detailed information on designing and implementing treatability studies for the RI/FS process is provided in the "Guide for Conducting Treatability Studies under CERCLA," Interim Final, EPA 540/2-89/058, December 1989. A summary of Chapter 2 (Overview of Treatability Studies) is incorporated in this paper. The remainder of that document provides protocols for implementing the studies.

DEFINING TREATABILITY STUDIES

Treatability studies are laboratory or field tests designed to provide critical data needed to evaluate and, ultimately, to implement one or more treatment technologies. These studies generally involve characterizing untreated waste and evaluating the performance of the technology under different operating conditions. These results may be qualitative or quantitative, depending on the level of treatability testing. Factors that influence the type or level of testing needed include: phase of the project [e.g., remedial investigation/feasibility study (RI/FS) or remedial design/remedial action (RD/RA)], technology-specific factors, and site-specific factors.

- Treatability studies conducted during the RI/FS to support remedy selection are generally used to determine whether the technology can achieve the anticipated Record of Decision (ROD) goals and to provide information to support the nine evaluation criteria to the extent possible.
- Treatability studies to support remedy implementation during RD are generally used to verify that the technology can achieve the ROD goals, optimize design and operating conditions necessary to ensure performance, and improve cost estimates.

LEVEL OF TREATABILITY STUDIES

Treatability studies should be performed in a systematic fashion to ensure that the data generated can support the remedy evaluation and implementation process. A well-designed treatability study can significantly reduce the overall uncertainty associated with the decision, but cannot guarantee that the chosen alternative will be completely successful. Care must be exercised to ensure that the treatability study is representative of the treatment as it will be employed (e.g., sample is representative of waste to be treated) to minimize the uncertainty in the decision. The method presented below provides a resource-effective means for evaluating one or more technologies.

There are three levels or tiers of treatability studies: laboratory screening, bench-scale testing, and pilot-scale testing. Some or all of the levels may be needed on a case-by-case basis. The need for and the level of treatability testing required are management decisions in which the time and cost necessary to perform the testing are balanced against the risks inherent in the decision (e.g., selection of a treatment alternative). These decisions are based on the quantity and quality of data available and on other decision factors (e.g., State and Community acceptance of the remedy, new site data). The flow diagram for the tiered approach in Figure 1 traces the stepwise review of study data and the decision points and factors to be considered.

- **Laboratory screening** is the first level of testing. It is used to establish the validity of a technology to treat a waste. These studies are generally low cost (e.g., $10K-50K) and usually require hours to days to complete. They yield data that can be used as indicators of a technology's potential to meet performance goals and can identify operating standards for investigation during bench- or pilot-scale testing. They generate little, if any, design or cost data and generally are not used as the sole basis for selection of a remedy.

- **Bench-scale testing** is the second level of testing. It is used to identify the technology's performance on a waste-specific basis for an operable unit. These studies generally are of moderate cost (e.g., $50K-250K) and may require days to weeks to complete. They yield data that verify that the technology can meet expected cleanup goals and can provide information in support of the detailed analysis of the alternative (i.e., the nine evaluation criteria).

- **Pilot-scale testing** is the third level of testing. It is used to provide quantitative performance, cost, and design information for remediating an operable unit. This level of testing also can produce data required to optimize performance. These studies are of moderate to high cost (e.g., $250K-1,000K) and may require weeks to months to complete. They yield data that verify

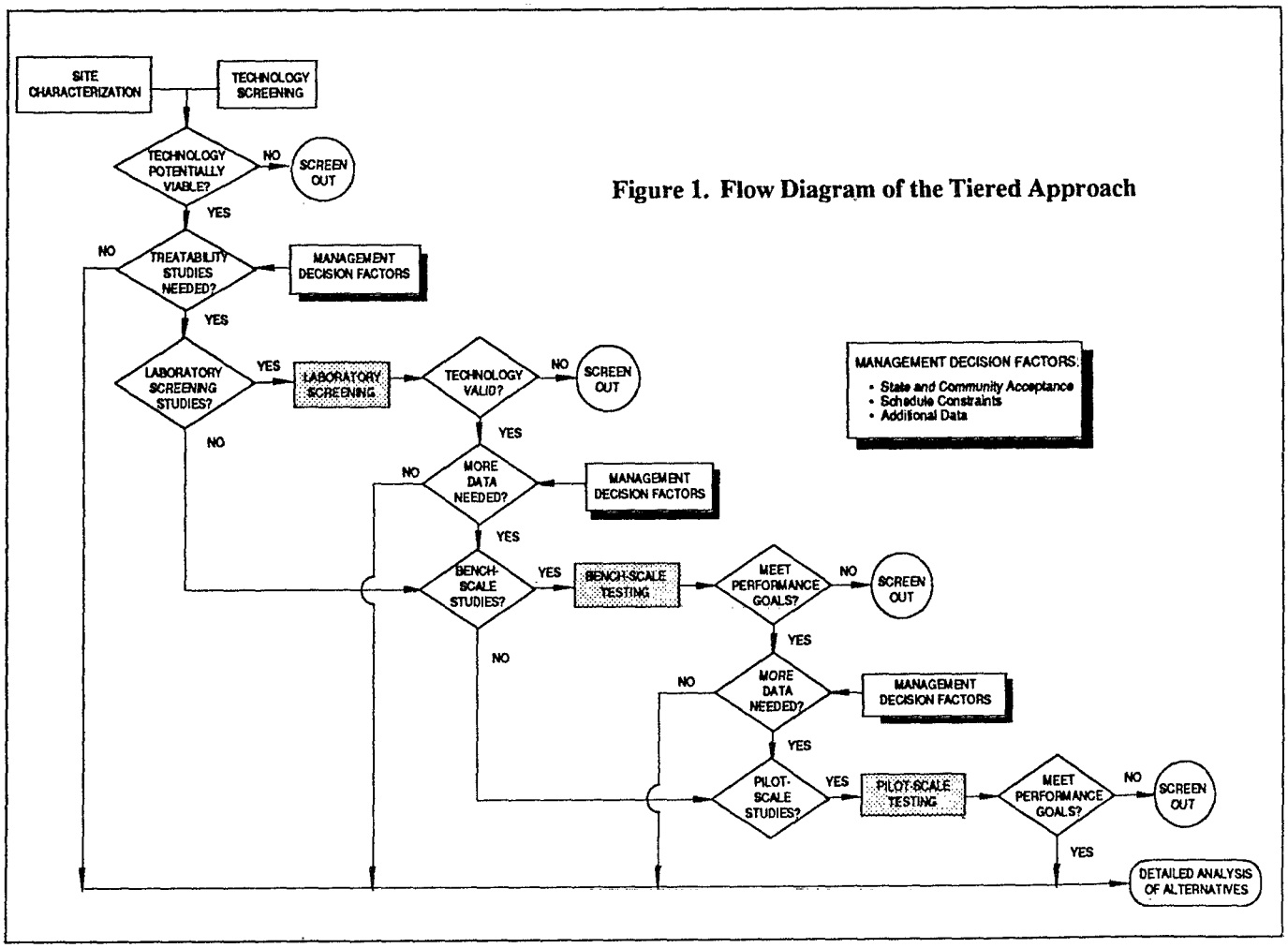


Figure 1. Flow Diagram of the Tiered Approach

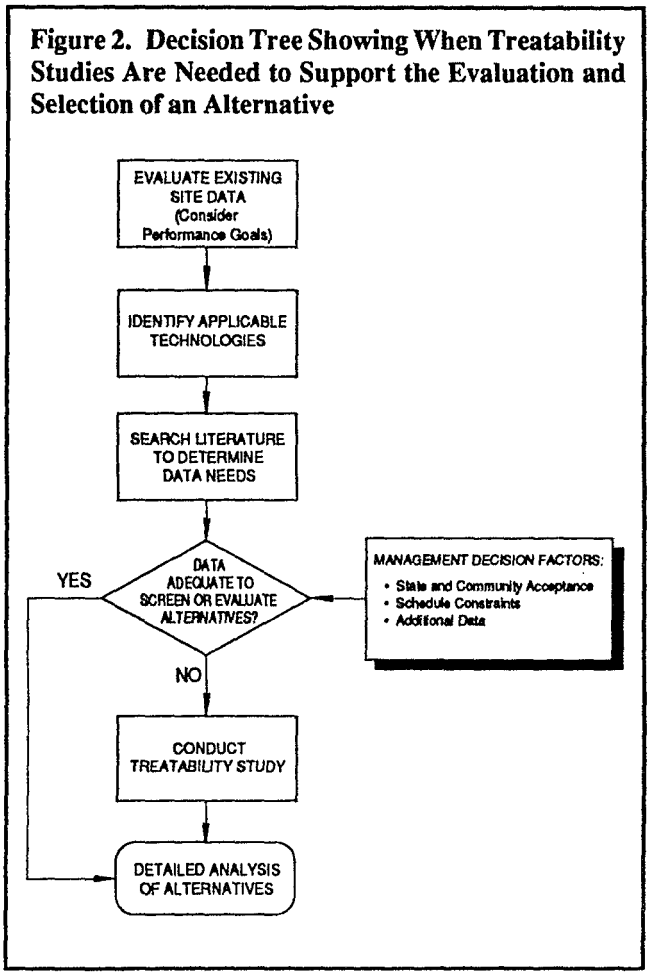
performance to a higher degree than the bench-scale and provide detailed design information. They are most often performed during the remedy implementation phase of a site cleanup, although this level may be appropriate to support the remedy evaluation of innovative technologies.

Technologies generally are evaluated first at the laboratory screening level and progress through the bench-scale to the pilot-scale testing level. A technology may enter, however, at whatever level is appropriate based on available data on the technology and site-specific factors. For example, a technology that has been studied extensively may not warrant laboratory screening to determine whether it has the potential to work. Rather, it may go directly to bench-scale testing to verify that performance standards can be met.

DETERMINING THE NEED FOR TREATABILITY STUDIES

Treatability studies for remedy evaluation and implementation represent good engineering practice. The determination of the need for and the appropriate level of a treatability study(ies) required is dependent on site-specific factors, the literature information available on the technology , and technical expert judgment. The latter two elements – the literature search and expert consultation – are critical factors in determining if adequate data are available or whether a treatability study is needed to provide those data. Figure 2 provides a decision tree for treatability studies in the RI/FS. Additional studies may not be needed if previous studies or actual implementation have encompassed essentially identical site conditions. The data and information on which this decision is based should be documented. Given the lack of full-scale experience with innovative technologies, pilot-scale testing will generally be necessary in support of remedy selection and implementation.

Figure 2. Decision Tree Showing When Treatability Studies Are Needed to Support the Evaluation and Selection of an Alternative



SUPERFUND PROCESS – TIMING OF TREATABILITY STUDIES

Treatability studies should be planned and implemented as soon as it is evident that insufficient information is available in the literature to support the decision necessary for remedy selection or implementation. Treatability testing of technologies may begin during the scoping phase, the initial phases of site characterization and technology screening, and continue through the RI/FS and into the RD/RA to support remedy implementation. Additional treatability studies of alternate technologies or treatment trains also may be needed later in the RI/FS process as other promising remedial alternatives are identified.

For many site types, initial data are available to identify potentially applicable technologies early during the scoping phase of the RI/FS for all or parts of the site. In those cases, the literature search, the planning, and the implementation of the treatability study can proceed. The planning of the studies should coincide with the scoping of the RI/FS to the extent practicable to ensure that data are gathered during the RI to support the technologies and associated treatability studies.

Similarly, treatability studies to support the remedy implementation also should be conducted as early in the RD as appropriate. As with the RI/FS treatability study, additional technology-specific site characterization data may be needed to aid in the design and implementation of the study.

TREATABILITY STUDY GOALS

Each level of treatability study requires appropriate performance goals. These goals should be specified before the test is conducted. The goals may need to be reassessed to determine appropriateness following test-

ing performance as a result of new information (e.g., ARARs), treatment train considerations or other factors. Pre-ROD treatability study goals will usually be based on the anticipated performance standards to be established in the ROD. This is because cleanup criteria are not finalized until the ROD is signed due to continuing analyses and ARARs determinations. The treatability goals should consider the following factors independently or in combination:

- Levels that are in protective of human health and the environment (e.g., contact, ingestion, leaching) if treated waste is left unmanaged or is managed;
- Levels that are in compliance with ARARs, including the land disposal restrictions;
- Levels that ensure a reduction of toxicity, mobility, or volume;
- Levels acceptable for delisting of the waste; and
- Levels set by the State or Region for another site with contaminated media with similar characteristics and contaminants.

Further, the program has as the treatment goal and expectation that treatment technologies and/or treatment trains generally achieve a 90 percent or greater reduction in the concentration or mobility of individual contaminants of concern. This goal complements the site-specific risk-based goals. There will be situations where reductions outside this range that achieve health-based or other site-specific remediation goals, may be appropriate. Treatment technologies should be designed and operated such that they achieve reductions beyond the target level indicated to ensure that the stated goals are achieved consistently.

Laboratory screening of treatability study goals allows for a go/no-go decision. For example, the goal may be a 50 percent reduction in mobility which would indicate the potential to achieve greater reduction (e.g., 90 percent) through additional refinement of the study. The achievement of this goal might indicate the advisability of expending additional resources on a bench-scale test to obtain a more definitive evaluation of the technology. Bench- and pilot-scale testing goals are those needed to select and/or implement the technology. For example, the bench-scale testing goal for solidification/stabilization could be to achieve a 90 percent or greater reduction in mobility of the principal constituents. In addition, the goals for the bench- or pilot-scale studies also may involve multiple waste treatment levels — the performance of which dictates the ultimate disposition of the waste (i.e., clean closure or landfill closure).

Post-ROD treatability study goals should reflect those performance standards specified in the ROD. They should also be achieved in the most resource-efficient manner.

ADMINISTRATIVE PLANNING

The planning process for treatability studies begins during the budget cycle in the year prior to the planned performance. At that time, the potential need for treatability studies and their cost is estimated to ensure adequate resources and to factor the study into the planning for the site (e.g., scheduling the RI/FS). In many cases, the RI/FS will not have been initiated at this time, and assumptions will need to be made. In view of the limited literature information that is currently available on technology performance, it is anticipated that one or more treatability studies may be necessary for most sites. *Funding for treatability studies is separate from RI/FS funding and is over and beyond the target of RI/FS cost of $750K.*

Planners need to take into consideration treatability studies to be performed by contractors, EPA, and other Federal Agencies (e.g., Corps of Engineers) to support the ROD and the RD/RA. Treatability study funds will be needed for Fund-lead sites and for selected Enforcement-lead sites if the Responsible Party (RP) is not performing the study. Funds also will be needed for oversight of the studies. Oversight of Fund-lead treatability studies will be allocated as part of the treatability study. Oversight of RP-lead treatability studies will be funded through the enforcement budget.

FUNDING

Treatability studies in support of the RI/FS or the RD/RA are funded from the "Other Remedial" account if they are Federally-funded. The amount of treatability study funding required is dependent on technology and site-specific factors. The section in this fact sheet entitled "Levels of Treatability Studies" provides a rough estimate of resources and time required to perform the studies. Resources required may vary greatly depending on site conditions and data needs.

In the event that treatability study funding requirements exceed planned treatability study allocations (either due to the costs of the studies or due to the need for

studies which were not planned for), these studies should be funded from the Region's "Other Remedial" account or other Regional monies through the SCAP process. Regions should contact Tom Sheckells (OERR/OPM, FTS 382-2466) for clarifications.

All treatability studies, whether performed by a contractor or EPA, are funded out of the Regional SCAP account. Procurement Requests (PR) used to initiate work should have activity code "9" to ensure proper record keeping.

CERCLIS

Treatability studies are coded in CERCLIS under the event code "TS" that provides for separate event coding for each treatability study for a given site. This allows for multiple treatability studies with separate funding (e.g., Federal-, State-, or Responsible Party-lead treatability studies).

PERFORMANCE OF TREATABILITY STUDIES

Fund-lead treatability studies generally will be conducted through the REM or ARCS contractors or their sub-contractors or contractors working for States. A list of vendors that have expressed interest in performing treatability studies has been compiled in the "Inventory of Treatability Study Vendors." A preliminary draft copy is scheduled for distribution in January 1990. Companies on this list should be notified of requests for proposals (RFPs) for treatability studies in accordance with the Federal Acquisition Regulations.

EPA and other Federal Agencies such as the Bureau of Mines also may perform select treatability studies on a case-by-case basis. Again, the funding of these activities is through the Regional SCAP allocations.

Enforcement-lead treatability studies generally will be accomplished through the RP contractor. There may be exceptions to this where the complexity of the site requires alternative options (e.g., State- or Federal-lead treatability studies for all or part of a site). The planning and performance of the study should be directed by the Region to ensure that the study results in the type and quality of data needed to support the decision.

TREATABILITY STUDY PROTOCOLS

Treatability studies need to be carefully planned to ensure that sufficient data of known, documented, and appropriate quality are generated to support the decision. The site-specific treatability study protocol is outlined in the Work Plan and the Sampling and Analysis Plan. These plans should, among other things, clearly describe: the experimental design, the treatability study goals, the Quality Assurance Project Plan, data management and interpretation, and reporting.

The treatability study work assignment is to require that the treatability study be developed in accordance with Agency guidance, factoring in literature, site-specific information, and expert consultation. The "Guide for Conducting Treatability Studies Under CERCLA" provides a general approach for treatability studies and provides a protocol for the preparation of the Work Assignment, Work Plan, Sampling and Analysis Plan, Health and Safety Plan, and the Community Relations Plan. The Agency also is developing a number of technology-specific treatability guidances which should be followed; the first of these on soil washing is scheduled to be issued in the second quarter of FY 1990. For more information on these documents, other sources of treatability study information, and for technical assistance in reviewing and performing treatability studies please contact Ben Blaney (ORD) at FTS/684-7406 or com. 513/596-7406.

TREATABILITY STUDY REPORT

The Agency has initiated an effort to ensure the consistency of treatability study reports and to provide a central repository of treatability studies to facilitate information dissemination. The "Guide for Conducting Treatability Studies under CERCLA" contains a standard report format that is to be followed for all treatability study reports. All work assignments and consent decrees are to contain a statement requiring that documents be developed in accordance with Agency policy.

Further, all Fund-lead and enforcement-lead oversight treatability work assignments are to include a provision requiring that a camera-ready master copy of the treatability study report be sent to the following address:

Attn: Ken Dostal
U.S. Environmental Protection Agency
Superfund Treatability Data Base
ORD/RREL
26 W. Martin Luther King Drive
Cincinnati, Ohio 45268

Information contained in these reports will be available through the Alternative Treatment Technology Information Center (ATTIC). For more information on ATTIC please call FTS 382-5747 or com. 202/382-5747.

TECHNICAL ASSISTANCE

Literature information and consultation with experts are critical factors in determining the need for and ensuring the usefulness of treatability studies. A reference list of sources on treatability studies is provided in the "Guide for Conducting Treatability Studies Under CERCLA."

It is recommended that a Technical Advisory Committee (TAC) be used. This committee may include experts on the technology(ies) to provide technical support from the scoping phase of the treatability study through data evaluation. Members of the TAC may include representatives from EPA (Region and/or ORD), other Federal Agencies, States, and consulting firms. Technical assistance may be obtained through the following:

- **The Office of Research and Development** (ORD) provides technical assistance on site remediation and treatability studies. The Superfund Technical Assistance Response Team (START) provides long-term site-specific support from the scoping phase through remedial design for sites identified by Regional management and selected for START support. The Technical Support Project (TSP) provides short-term support of a similar nature. ORD assistance in the planning, performance, and/or review of treatability studies can be accessed through either mechanism. ORD also has the Treatability Assistance Program (TAP) which is developing technology-specific treatability study protocols, bulletins, and a computerized database. For further information on treatability study support or the TAP please contact Ben Blaney (ORD) at FTS 684-7406 or com. 513/569-7406, Rich Steimle (OSWER) at FTS 382-7914 or com. 202/382-7914, or a Regional Forum member.

- **Bureau of Mines** (BOM) has technical expertise and experience in the development of technologies to remove metals and other inorganic chemicals from solids and liquids. Contact William Schmidt at FTS 634-1210 or com. 202/634-1210 for information.

- **The U.S. Army Corps of Engineers** (COE) may perform or oversee treatability studies required for RI/FS or RD/RA. For information, contact Joe Grasso (COE) at com. 402/691-4532.

FOR FURTHER INFORMATION

In addition to the contacts identified above, the appropriate Regional Coordinator for each Region located in the Hazardous Site Control Division/Office of Emergency and Remedial Response or the CERCLA Enforcement Division/Office of Waste Programs Enforcement should be contacted for additional information or assistance.